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13. ABSTRACT *(Maximum 200 words)*

This research involved studies of dual-polarization meteorological radar observations of thunderstorms, particularly observations of electrically aligned particles in active storms. Radar data indicate the presence of large supercooled drops above freezing level in a small, developing New Mexico storm in the summer of 1993. This data is of particular interest to meteorologists investigating how precipitation initially forms in the relatively cold, dry storms of the desert southwest. Other research findings include analysis of the New Mexico Institute of Mining and Technology's Lightning Interferometer observations of intracloud lightning with storm structure. Intracloud discharges in small New Mexico storms were observed to transfer negative charge upward from the storm precipitation core to the upper part of the thunderstorm. This was consistent with dual-polarization observations of ice crystals that were vertically aligned by the storm's electric field in the upper part of the cloud prior to the discharges. Such electric field alignment observations may be used to remotely determine the electric field and charge structure within a thunderstorm.

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FINAL REPORT
AASERT GRANT F49620-92-J-0320

GRADUATE RESEARCH TRAINING ON A DUAL-POLARIZATION METEOROLOGICAL RADAR PROJECT

January 1, 1993 to June 30, 1996

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This AASERT grant provided graduate research assistantship and related support for dual-polarization meteorological radar studies of thunderstorms, in particular of electrically aligned particles in active storms. The initial person to be supported on the project, Paul Gross, decided after one summer with the project to return to his MSc work at Boston University, as described in the first year report. Some observations which he and our radar technician, Steven McCrary, obtained during the summer of 1993 are part of a paper to be published in the January issue of the Journal of Atmospheric Science (Blyth et al., 1997). The observations showed the presence of large supercooled drops above the freezing level in a small, developing New Mexico storm, which are of significant interest to the question of how precipitation initially forms in the relatively dry, cold storms of the desert southwest.

Another Ph.D. graduate student, Richard Scott, has been supported by the grant since the beginning of its second year through a 6 month extension to the grant following its final, third year (i.e. for 2.5 years from January 1994 through June 1996). His studies, which are still being completed, have had several aspects. His early studies on the project have been described in the 2nd annual grant report and resulted in some of the first comparisons of good quality intracloud lightning observations from Tech's Lightning Interferometer with storm structure. These were presented at two scientific conferences (Scott et al., 1995a, 1995b) and showed that intracloud lightning discharges in relatively small New Mexico storms transfer negative charge from within the precipitation core of the storm upward into the upper part of the storm. This was consistent with the dual-polarization observations that ice crystals were being vertically aligned by the electric field of the storm in the upper part of the cloud prior to the discharges. The results have been included as part of paper by Shao and Krehbiel (1996) which describes the nature of intracloud lightning discharges from studies with the interferometer system. Additional case studies in which lightning observations are to be compared to storm structure and alignment are awaiting analysis.

A main thrust of Mr. Scott's studies with the radar has been to follow up on work by the preceeding graduate student on the project (T. Chen) to determine if the electrical alignment observations from the radar can be used to remotely ascertain the electric field and charge structure of a storm. The processing and display requirements for this were developed in the final year of the grant, and good quality observations were obtained during the summer of 1996. First results of the studies were reported at the recent Fall Annual Meeting of the American Geophysical Union (Scott and Krehbiel, 1996). This has involved scanning the storms 3-dimensionally and displaying the observations in a new way, perpendicular to individual radar scan planes. Analysis of the observations is continuing, and, along with the lightning comparisons, will form the basis of Mr. Scott's Ph.D. dissertation.

Also partially supported by the grant were final publication of the original observations from the radar (Krehbiel et al., 1996) and an additional paper at the Vail Radar Meterology conference concerning the use of dual circular polarization radar for studying rain and other microphysical quantities in storms (Krehbiel et al. 1995).

PUBLICATIONS

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